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Effect of sources and split application of phosphorus on dry matter accumulation, nutrients uptake and soil properties under partially reclaimed salt affected soil

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Summary

A field experiment was conducted at Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during *Kharif* season 2012 to evaluate the effect of sources and split application of phosphorus on dry matter accumulation, nutrients uptake and soil properties under partially reclaimed salt affected soil. The experiment comprised of seven treatments *i.e.* (T_1) control, (T_2) 60 kgP_2O_5 ha^{-1} basal through DAP, (T_3) 45 kg basal +15 kg P_2O_5 ha^{-1} at tillering through DAP, (T_4) 30 kg basal+15 kg P_2O_5 ha^{-1} through DAP, (T_5) 60 kg P_2O_5 ha^{-1} basal through SSP, (T_6) 45 kg basal + 15 kg P_2O_5 ha^{-1} in Randomized Block Design replicated thrice. The rice variety NDR-359 was taken as test crop. Among sources of phosphatic fertilizer *viz.*, single super phosphate and diammonium phosphate, single superphosphate were found more effective over diammonium phosphate with respect of dry matter accumulation, phosphorus uptake, EC, pH, OC and available nitrogen, phosphorus and potassium in soil.

Key words : Rice, SSP, DAP, Split application, Partially reclaimed salt affected soil

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Introduction

Rice (*Oryza sativa* L.), is the prince among the cereals as a premier food crop not only in India, but also in the world. Uttar Pradesh is the largest rice growing state after West Bengal in the country, in which rice is being grown over an area of 6.69 m ha with production and productivity of 11.80 m tones and 2073 kg ha^{-1}, respectively (Anonymous,2012). Phosphorus is one of the key elements necessary for the growth of all forms of life on planet earth including plants, animals and micro-organisms as components of nucleic acids, phospholipids that compose cellular membranes, ATP and ADP molecules and intermediate compounds of respiration and photosynthesis (Taiz and Zeiger, 1998). Utilization efficiency of fertilizer phosphorus by the crop is very low and varies from 8- 33 per cent depending on the nature of crops and soils (Aulakh and Pasricha, 1991). The availability of applied phosphorus in soil depends

upon the phosphorus from secondary reaction products formed in the soil due to transformation of fertilizer phosphorus.Therefore, the approaches of P management may be different in P rich soil and deficient soils. Effective phosphatic fertilizer management includes choice of fertilizer sources and split application to manage the fixation and forms of secondary reaction products is important because water soluble phosphorus is added to the soil, part of it is taken up by the plant and rest quickly becomes fixed in less available forms as the P reacts with other soil components. The objectives of the present study was to investigate the effect of sources and split application of phosphorus on dry matter accumulation, nutrients uptake and soil properties under partially reclaimed salt affected soil.

Resource and Research Methods

A field experiment was conducted during *Kharif* season 2012 at the Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). The seven treatments were comprised *viz.*, T_1 - control, T_2 - 60 kgP_2O_5 ha^{-1} basal through DAP, T_3 - 45 kg basal +15 kg P_2O_5 ha^{-1} at tillering through DAP, T_4 - 30 kg basal+15 kg P_2O_5 ha^{-1} through DAP, T_5 - 60 kg P_2O_5 ha^{-1} basal through SSP, T_6- 45 kg basal + 15 kg P_2O_5 ha^{-1} through SSP, T_7 -30 kg basal + 15 kg at tillering + 15 kg P_2O_5 ha^{-1} at PI stage through SSP in Randomized Block Design with three replications. The rice variety Sarjoo-52 was taken as a test crop. The experimental soil was silty loam in texture having pH (1:2.5) 8.8, EC (1:2.5) 0.40 dSm^{-1}, organic carbon 2.5g kg^{-1}, available N 180, P_2O_5 15 and K_2O 250 kgha^{-1}. For the dry matter accumulation plant samples were taken randomly the plots closed to ground level and oven dried at 65^{0}C till constant the weight. On the basis of oven dry weight, total dry weight was computed. Phosphorus content in grain and straw and physico-chemical properties were determined as per standard procedure described by Jackson (1973).

Research Findings and Discussion

The results obtained from the present investigation

Table1: Effect of sources and split application of phosphorus on dry matter accumulation and phosphorus uptake by rice crop

Treatments	Dry matter accumulation (g^{-2})	Yield (kg ha^{-1-})		Phosphorus uptake (kg ha^{-1})	
		Grain	Straw	Grain	Straw
Control	662.40	24.12	42.12	7.80	5.94
60 kgP_2O_5 ha^{-1} basal through DAP	953.00	35.15	60.15	11.41	7.86
45 kg basal +15 kg P_2O_5 ha^{-1} at tillering through DAP	1120.00	42.50	69.50	12.81	8.30
30 kg basal+15 kg P_2O_5 ha^{-1} +15 kg P_2O_5 ha^{-1} at PI stage through DAP,	1030.00	38.50	64.50	12.00	8.16
60 kg P_2O_5 ha^{-1} basal through SSP	1004.00	37.70	62.70	12.11	8.18
45 kg basal + 15 kg P_2O_5 ha^{-1} through SSP	1232.00	46.60	76.60	13.40	8.62
30 kg basal + 15 kg at tillering + 15 kg P_2O_5 ha^{-1} at PI stage through SSP	1144.00	43.20	71.20	12.80	8.33
S.E.±	34.94	1.41	1.71	0.42	0.26
C.D. (P=0.05)	103.81	4.18	5.06	1.20	0.78

Table 2: Effect of sources and split application of phosphorus on soil properties after harvest of the crop

Treatments	Soil properties			Available nutrients (kg ha^{-1})		
	pH (1:2.5)	EC (1:2.5)	OC (%)	N	P	K
Control	8.80	0.37	0.33	116.5	14.6	238.8
60 kgP_2O_5 ha^{-1} basal through DAP	8.76	0.34	0.33	170.6	16.5	255.6
45 kg basal +15 kg P_2O_5 ha^{-1} at tillering through DAP	8.75	0.32	0.35	173.5	16.8	258.6
30 kg basal+15 kg P_2O_5 ha^{-1} +15 kg P_2O_5 ha^{-1} at PI stage through DAP,	8.75	0.33	0.34	171.2	16.6	256.5
60 kg P_2O_5 ha^{-1} basal through SSP	8.75	0.33	0.34	172.3	16.7	257.5
45 kg basal + 15 kg P_2O_5 ha^{-1} through SSP	8.72	0.31	034	175.4	16.9	260.4
30 kg basal + 15 kg at tillering + 15 kg P_2O_5 ha^{-1} at PI stage through SSP	8.73	0.32	0.38	173.0	16.8	258.2
S.E.±	0.11	0.04	0.05	2.18	0.21	3.25
C.D. (P=0.05)	NS	NS	NS	6.84	0.63	9.67

NS= Non-significant

as well as relevant discussion have been summarized under following heads :

Dry matter accumulation :

The data (Table 1) revealed that the application of phosphorus with SSP was found most effective source than DAP due its solubility effects. The maximum dry matter accumulation (1232g^{-2}) was recorded with T_6- 45 kg basal + 15 kg P_2O_5 ha^{-1} applied through SSP which was statistically at par with T_7- 30 kg basal + 15 kg at tillering + 15 kg P_2O_5 ha^{-1} and panicle stage through SSP and significantly superior over rest of the treatments. The minimum dry matter accumulation (662.4 g^{-2}) was received with control. More response of SSP over DAP might be due to additional nutrient sulphur occurred in SSP. Similar findings were also reported by Gupta *et al.* (1984). The variation in dry matter accumulation under different splitting might be due to differences in availability of phosphorus in soil.

Nutrient uptake :

The data presented in Table 1 that the maximum phosphorus uptake was found in grain (13.40) and straw (8.62 kg ha^{-1}) with the application of T_6- 45 kg basal + 15 kg P_2O_5 ha^{-1} applied through SSP where significant differences were over T_5, T_4, T_2 and T_1 and statistically at par with T_7 and T_3 by grain, however, the maximum phosphorus uptake (8.62 kg ha^{-1}) was also recorded by the straw which was significantly superior over the control and statistically at par over rest of the treatments. It's also observed that the SSP proved superior over DAP in regards to withdrawal of phosphorus through crop. This might be due to significant enhancing in yield and P concentration in grain and straw under the treatments. These results are proved by the similar findings of Bhardwaj *et al.* (1974) and Raju (1985).

Soil properties :

The data presented in Table 2 revealed that the maximum reduction in pH (8.72) and E.C. (0.31) were received with T_6 and minimum with control. Where, maximum buildup in organic carbon (0.38%) was received with the application of T_7- 30 kg basal + 15 kg at tillering + 15 kg P_2O_5 ha^{-1} at PI stage through SSP followed by T_3- 45 kg basal +15 kg P_2O_5 ha^{-1} at tillering through DAP and minimum was received with T_2 and T_1. This might be due to the incorporation of biomass through root and leaf fall from the plants to varying degrees and creation of favourable conditions for the growth of micro-organisms. The similar findings were also reported by Mishra and Lal (1994).

Available nutrients at after harvest of the crop :

The data presented in Table 2 evident that the maximum buildup of available nutrients *viz.,* nitrogen (175.4), phosphorus (16.9) and potassium (260.4) were received with the application of T_6- 45 kg basal + 15 kg P_2O_5 ha^{-1} at tillering through SSP which was statistically at par with rest of the treatment except control. This might be due to release in available from their native insoluble the compound in soil due to addition of SSP and DAP appeared superior which might be due to its greater amelioration effect on soil. These are also corroborate with the findings of Raju (1985), also reported in increase in nitrogen availability due to addition of SSP (Singh *et al.,* 2010 and Fageria *et al.,* 2013).

Conclusion :

From the present investigation, it is concluded that among sources of phosphatic fertilizer single super phosphate and diammonium phosphate, single superphosphate was found better over diammonium phosphate with respect of dry matter accumulation, phosphorus uptake, depletion in EC, pH and build up in organic carbon, available nitrogen, phosphorus and potassium in soil.

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